

Modular System to Enable Extravehicular Activity

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The ability to perform extravehicular activity (EVA), both human and robotic, has been identified as a key component to space missions to support such operations as assembly and maintenance of space system (e.g. construction and maintenance of the International Space Station), and unscheduled activities to repair an element of the transportation and habitation systems that can only be accessed externally and via unpressurized areas. In order to make human transportation beyond lower earth orbit (BLEO) practical, efficiencies must be incorporated into the integrated transportation systems to reduce system mass and operational complexity. Affordability is also a key aspect to be considered in space system development; this could be achieved through commonality, modularity and component reuse. Another key aspect identified for the EVA system was the ability to produce flight worthy hardware quickly to support early missions and near Earth technology demonstrations. This paper details a conceptual architecture for a modular extravehicular activity system (MEVAS) that would meet these stated needs for EVA capability that is affordable, and that could be produced relatively quickly. Operational concepts were developed to elaborate on the defined needs and define the key capabilities, operational and design constraints, and general timelines. The operational concept lead to a high level design concept for a module that interfaces with various space transportation elements and contains the hardware and systems required to support human and telerobotic EVA; the module would not be self-propelled and would rely on an interfacing element for consumable resources. The conceptual architecture was then compared to EVA Systems used in the Shuttle Orbiter, on the International Space Station to develop high level design concepts that incorporate opportunities for cost savings through hardware reuse, and quick production through the use of existing technologies and hardware designs. An upgrade option was included to make use of the developing suitport technologies.

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